Penalty functions in the Optimal Design of New Water Distribution Networks

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ABSTRACT

Water supply networks represent the main investment in water distribution projects. Therefore, it is necessary to reduce their costs by choosing the best design and pipe diameters, while considering operational limits of velocity and pressure. Bio-inspired optimization techniques are commonly used to solve this design problem. Nevertheless, these techniques have a major drawback: due to their unrestricted characteristic, to maintain the solution inside the problem boundaries, a penalty function is necessary. These functions can be neither too hard, so as to avoid a wide search across the space, nor too soft, leading to unfeasible solutions [1]. Another drawback to be highlighted is the sudden change in pipe diameters that some of those stochastic optimization processes can achieve [2], which in many cases is far from the reality. This contribution evaluates the performance of eight penalty functions for Genetic Algorithms and Particle Swarm Optimization, in classical water distribution design problems. Then, using the best penalty function found, an optimization procedure that considers gradual diameters changes is developed. Finally, we compare the benefits obtained with other results found previously.

REFERENCES

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